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EXAMINER

STOUFFER, KELLY M

ART UNIT PAPER NUMBER

1762

DATE MAILED: 08/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/733,201

Applicant(s)

DERDERIAN ET AL.

Examiner

Kelly Stouffer

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 December 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-79 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 13-34, 36 and 39-79 is/are rejected.
- 7) ☒ Claim(s) 9-12, 35, and 37-38 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 December 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "10" and "12" have both been used to designate substrate on page 9 line 16 of the specification. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claim 26 is objected to because of the following informalities: N₂O in line 2 should be NO_x. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 8 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: It is unclear what x and y

encompass in line 2 of the claim. These elements are critical in determining the scope and limitations of the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-5, 14-17, 27-34, 36, and 39 are rejected under 35 U.S.C. 102(b) as being anticipated by US Publication number 2001/0041250 A1 to Werkhoven et al. Claim 1 of the applicant requires a porous oxide deposited by atomic layer deposition (ALD) on a substrate in a chamber with repeated steps of a first adsorbed monolayer and second step of contact with oxygen and nitrogen remote plasma. Werkhoven et al. discloses a process for forming a porous oxide (containing channels, paragraph 0056 lines 1-8) on a substrate in a chamber by ALD (paragraphs 0034 and 0042 lines 3-6 and 1-3 respectively) consisting of the steps of depositing a monolayer of the oxide in paragraph 0055 lines 1-5 and then contacting it with oxygen and nitrogen remote plasma (paragraph 0060 lines 1-5) where the oxygen plasma source contains ozone (paragraphs 0046 lines 6-7 and paragraph 0048 et seq.) Werkhoven et al. meets all the recitations of claim 1, at least as broadly recited by claim 1.

In claims 2 and 3 the applicant requires an electrically insulative oxide, and an oxide comprising SiO₂. Werkhoven et al. discloses the film as SiO₂ in paragraph 0085

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lines 1-2, which by nature may be electrically insulative. Werkhoven et al. meets all the recitations of claims 2 and 3, at least as broadly recited by claims 2 and 3.

In claims 4 and 14 the applicant requires an oxide comprising Al_2O_3 with a trimethyl aluminum precursor and aluminum component in the film. Werkhoven et al. discloses the film as Al_2O_3 with a trimethyl aluminum precursor and aluminum component in the film in paragraphs 0088 and 0089 et seq. Werkhoven et al. meets all the recitations of claims 4 and 14, at least as broadly recited by claims 4 and 14.

With regard to claims 15 and 17, the gaseous precursor for silicon dioxide includes a silane in paragraph 0046 lines 1-6. . Werkhoven et al. meets all the recitations of claims 15 and 17, at least as broadly recited by claims 15 and 17.

With regard to claim 16, Werkhoven et al. discloses a silicon source gas that can be any gas containing silicon in paragraph 0046 lines 1-6. This includes TEOS as required by the applicant. Werkhoven et al. meets all the recitations of claim 16, at least as broadly recited by claim 16.

With regard to claims 27-29, Werkhoven et al. discloses the oxygen source gas as O_2 or O_3 in paragraph 0046 lines 6-7 and paragraph 0048 et seq. Werkhoven et al. meets all the recitations of claims 27-29, at least as broadly recited by claims 27-29.

With regard to claims 30-34, 36, and 39, Werkhoven et al. discloses the nitrogen source and oxygen source processed into a plasma by a plasma generator 60 in Figure 1 as described in paragraph 0060 lines 1-5. The nitrogen source can be separate from the oxygen source and fed into the chamber at different times spaced from one another or included in the oxygen source as a mixture from the same plasma generator 60.

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The two sources can also be entered into the chamber at times that overlap one another as disclosed in paragraph 0072 lines 1-4. Werkhoven et al. meets all the recitations of claims 30-34, 36, and 39, at least as broadly recited by claims 30-34, 36, and 30.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
5. Claims 40-48, 57-58, and 65-73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werkhoven et al. Werkhoven et al. is described in section 3 above and includes all recitation of claims 40-48, 57-58, and 65-73 at least as broadly recited by the applicant with the exception of including specific percentage by volume concentrations of nitrogen in the remote plasma. Werkhoven et al. teaches that the reaction between the silicon layer and the nitrogen source (in this case ammonia) has a different thermodynamic capability than the reaction between the silicon layer and the

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oxygen source (paragraph 0070 et seq.). The appropriate concentration of nitrogen is said by Werkhoven et al. to be by routine experimentation to account for the thermodynamic competition between the nitrogen and oxygen reactions in paragraph 0070 et seq. The variable of nitrogen concentration in the plasma depends upon the reaction conditions, and its importance is in accounting for the thermodynamic competition therefore it is a result-effective variable and its modification is not inventive.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Werkhoven et al. by routine experimentation to include nitrogen concentrations in the nitrogen and oxygen remote plasma in the ranges of 0.01-90%, 0.1-10%, 0.1-3%, 0.01-1% by volume in order to account for the thermodynamic competition between the oxygen and nitrogen reactions with the surface layer absent evidence showing a criticality for the abovementioned ranges. (See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955))

6. Claims 5-8, 13, and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werkhoven et al. in view of US Patent number 4652463 to Peters. Werkhoven et al. is described above and includes a method for making an insulative oxide film (aluminum oxide) with a vapor precursor of trimethyl aluminum. Werkhoven et al. in paragraph 0017 et seq. also describes the desirability of a layer comprising a conductive material to reduce electromigration. Werkhoven et al. does not include using a conductive layer such as indium oxide, tin oxide, or indium-tin oxide (a film that contains multiple cations) with precursors of trimethyl tin or trimethyl indium. Peters teaches a method for making a conductive oxide film that consists of indium oxide, tin

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oxide, or indium-tin oxide with precursors of trimethyl tin or trimethyl indium (column 7 lines 40-46) because indium oxide, tin oxide, and indium-tin oxide have properties of high transparency, mechanical hardness, and environmental stability (column 1 lines 40-44).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Werkhoven et al. to include film of indium oxide, tin oxide, or indium-tin oxide with precursors of trimethyl tin or trimethyl indium as taught by Peters in order to produce a film that has properties of high transparency, mechanical hardness, and environmental stability.

7. Claims 21-26, 59-64, and 74-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werkhoven et al. in view of US Patent number 6960537 to Shero et al. Werkhoven et al. is described above and includes an ALD method for producing an oxide film that includes the use of nitrogen remote plasma. Werkhoven et al. does not include the nitrogen source of the remote plasma to be N_2 , N_2O , or NO . Shero et al. teaches the source gas of the nitrogen remote plasma to be N_2 , N_2O , or NO in order to provide a plurality of nitrogen sources to the inlet 54 in Figure 1 as disclosed in column 8 lines 5-20.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Werkhoven et al. to include the nitrogen source of the remote plasma to be N_2 , N_2O , or NO as taught by Shero et al. in order to provide a plurality of nitrogen sources to the plasma generator and reaction chamber.

Allowable Subject Matter

8. Claims 9-12, 35, 37-38 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 9-12 require precursors of indium tin oxide to be entered into the chamber at simultaneously or at different times where the times either overlap or are spaced from one another. Werkhoven et al. does not include a provision for pulse times for any multicomponent precursors, and Peters does not include any information regarding delivery of the indium tin oxide precursors. These references, alone or in combination, do not meet the limitations of claims 9-12.

Claims 35 and 37-38 require separate remote plasma sources for the nitrogen and oxygen remote plasmas. Werkhoven et al. is described above and includes the entrance of a mixture of nitrogen and oxygen remote plasma into a deposition chamber but does not include separate remote plasma sources. US Publication number 2006/0174833 to Yamazaki et al. teaches separate remote plasma sources 26 and 36 in Figure 5 for nitrogen and oxygen remote plasma in order to suppress film growth phenomena resulting from a high independent concentration of oxygen reacting with the first layer in paragraphs 0107-0109 et seq. but does not have a filing date that would allow it to be usable as prior art. Therefore these references do not meet the limitations of claims 35 and 37-38.

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Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Igeta et al. shows a similar procedure

Park et al. shows a similar procedure

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kelly Stouffer whose telephone number is (571) 272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kelly Stouffer
Examiner
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A handwritten signature in black ink, appearing to read 'B. Chen', with a stylized flourish at the end.

BRET CHEN
PRIMARY EXAMINER